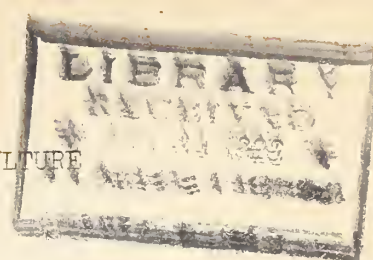


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OFFICE OF CEREAL INVESTIGATIONS
BUREAU OF PLANT INDUSTRY, U. S. DEPT. AGRICULTURE



RUST INVESTIGATIONS

(Dr. H. B. Humphrey, Pathologist in Charge)
Barberry Eradication. (Dr. F. E. Kempton, Pathologist in Charge)

PROGRESS OF BARBERRY ERADICATION, 1922

(Extract from Cereal Courier, Dec. 31, 1922)

Marked progress has been made in all phases of the barberry eradication campaign during 1922. With the increased Federal appropriation which became available July 1, and with excellent weather conditions for field operations, an area equivalent to 197 counties was surveyed in the 13 cooperating States. This includes 15 counties in Minnesota and one county in Iowa which were surveyed on State funds. A total of 209,397 bushes were located on 5,918 properties and 729,721 bushes were removed from 6,408 properties. Of these, 500,000 were bushes 6 to 18 inches in height which had been found and reported previously in one woodland in Grant County, Wis.

Excellent cooperation has been extended by farmers and other individual property owners, by newspapers, and by organizations of bankers, business men, railroad officials, millers, etc. County farm organizations have shown their increased interest in the campaign by urging that their counties be surveyed as soon as possible. Demonstration material has been furnished to each State and used to advantage at State and county fairs and other public gatherings.

Through the cooperative efforts of the Conference for the Prevention of Grain Rust, an organization composed of the Governor, the Commissioner of Agriculture, a representative of the State Agricultural Experiment Station, and the President of the State Farm Bureau Federation or corresponding farmers' organization of each State interested, and an additional membership at large composed of representatives of milling associations, railroads, implement dealers, bankers, National farmers' organization, and other business interests, much assistance has been given in sending publicity material to all classes of people in the barberry eradication area. This included charts with samples of barberries, calling attention to the losses caused by this shrub, placed in banks, railway stations, elevators, and other public buildings in most of the cities and towns of the 13 States. Because of the special interest of these organizations, individual property owners have cooperated even better than in the past.

Rust Spreads from Bushes

Intensive studies have been made of the spread of rust from barberries to surrounding fields of grains and grasses. These areas of local rust epidemics have been mapped and the degree of infection noted at various distances from the barberry bushes. Several of these local epidemics in the vicinity of Northfield, Minn., spread until they met in one extensive epidemic. At Burlington, Colo., 12 bushes

were responsible for an epidemic that spread from 3 to 5 miles on each side of the town. Near Alert, Decatur Co., Ind., one barberry bush was responsible for the almost complete destruction of wheat in two nearby fields and lesser losses in an area of 20 square miles. Farmers estimated that the financial loss caused by this one bush during the summer of 1922 was at least \$12,000.

Hunting Rust with Airplanes

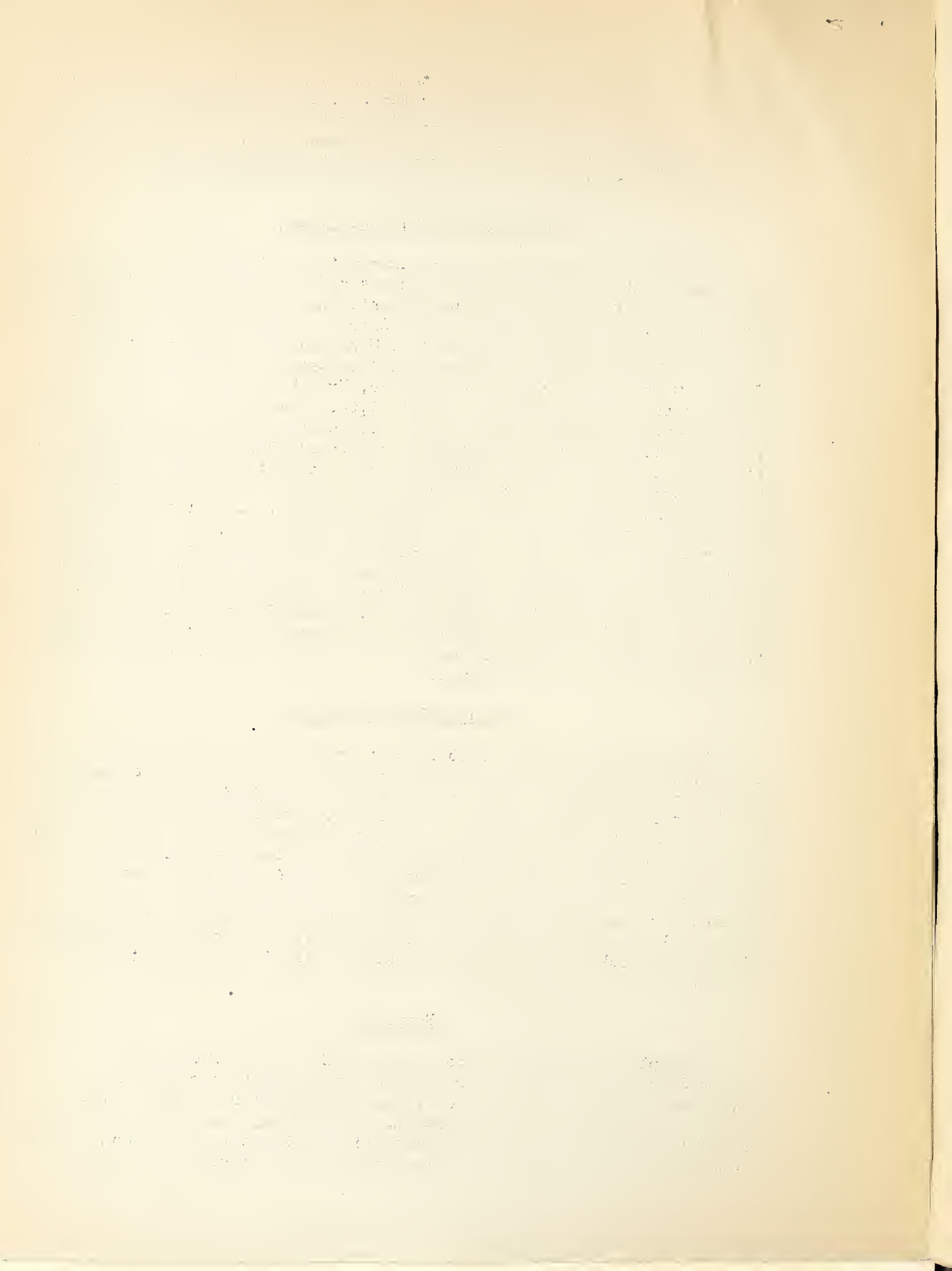
Airplanes were used to ascertain how far rust spores were distributed by air currents. This investigation was made possible by the cooperation of the Air Service of the War Department, which furnished planes and pilots. Flights were made from fields at San Antonio, Texas; Fort Crook, Omaha, Nebr.; Fort Sill, Okla.; Minneapolis, Minn. (in cooperation with the Minnesota National Guard); Chanute Field, Rantoul, Ill.; McCook Field, Dayton, Ohio; and Camp Knox, Louisville, Ky. Spores of stem rust were found in the air at altitudes of from 1,000 to 10,000 feet. Spores which were caught at altitudes ranging from 1,000 to 7,000 feet germinated fairly well. The average percentage of spores which germinated was 11.2. It is significant that the number of spores caught in the air decreases rather rapidly as the distance from rusted grains and grasses increases. There was no evidence that any appreciable amount of rust developed in the barberry eradication area as a result of spores blown from the South. As far as observations go, in the barberry eradication area, the only rust which had developed by the end of the first week in June clearly came from local barberries, from which rust already had been traced directly in some localities to a distance of at least a mile and a half. Apparently, epidemics developing in the barberry eradication area result from spores blown from local infection areas near barberries rather than from spores blown from the South.

Escaped Barberry Bushes

The spread of escaped barberries to open woodlands, fence rows, rocky ledges, brushy pastures, and stream banks has become the most serious problem of the campaign. During the past year, 133,365 escaped bushes have been found on 830 properties. The great number of these were in the States of Michigan, Ohio, Illinois, Wisconsin, Minnesota, and Iowa. During the entire campaign, 3,760,351 barberries were found on farms, only 331,301 of which were cultivated while 3,428,550 have been escaped bushes. These areas are being carefully mapped in order to facilitate the complete eradication of seedlings and sprouts. All bushes in representative areas in Iowa, Wisconsin, Illinois, Michigan, and Ohio have been treated either with rock salt or sodium arsenite as trials of that method of eradicating escaped barberries.

Resurvey

A complete resurvey has been made in 201 of the 276 counties surveyed in previous years, and a resurvey also has been made in all cities and towns covered in the original farm-to-farm survey. In this resurvey, 83,740 sprouts and thousands of seedlings were found and removed during the past year. It has become evident that several resurveys will be necessary. If the entire root system is not removed when barberry



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bushes are dug, sprouts may grow even from small bits of the roots which are left in the soil. To go back after a bush has been dug and find all of these sprouts is difficult and expensive. Furthermore, it is almost impossible to remove all of the roots which have entwined with the roots of trees or which have grown into the crevices between rocks. In those areas where there are many escaped bushes, tremendous numbers of seedlings also may appear as long as three years after the bushes have been dug. To destroy all of these seedlings by digging is almost impossible. Attempts therefore have been made to kill the bushes by means of chemicals.

Killing Bushes with Chemicals

Experiments on chemical methods of eradication were begun in September, 1921. About 40 different chemicals were tried on large barberry bushes in the field. Two chemicals, rock salt and sodium arsenite, have given uniformly good results, meeting the 3 chief requirements, namely, availability, cheapness, and effectiveness. Crushed rock salt fulfills all these requirements. For the average-sized barberry, 10 pounds of rock salt piled around the base is certain death. It may be applied at any time of the year. A dilute solution of sodium arsenite, one pound to 5 gallons of water, applied at the rate of 2 gallons per bush as a drench at the base has been found to be effective when applied at any time in the growing season, but its action when applied in the late fall and winter is not yet fully determined.

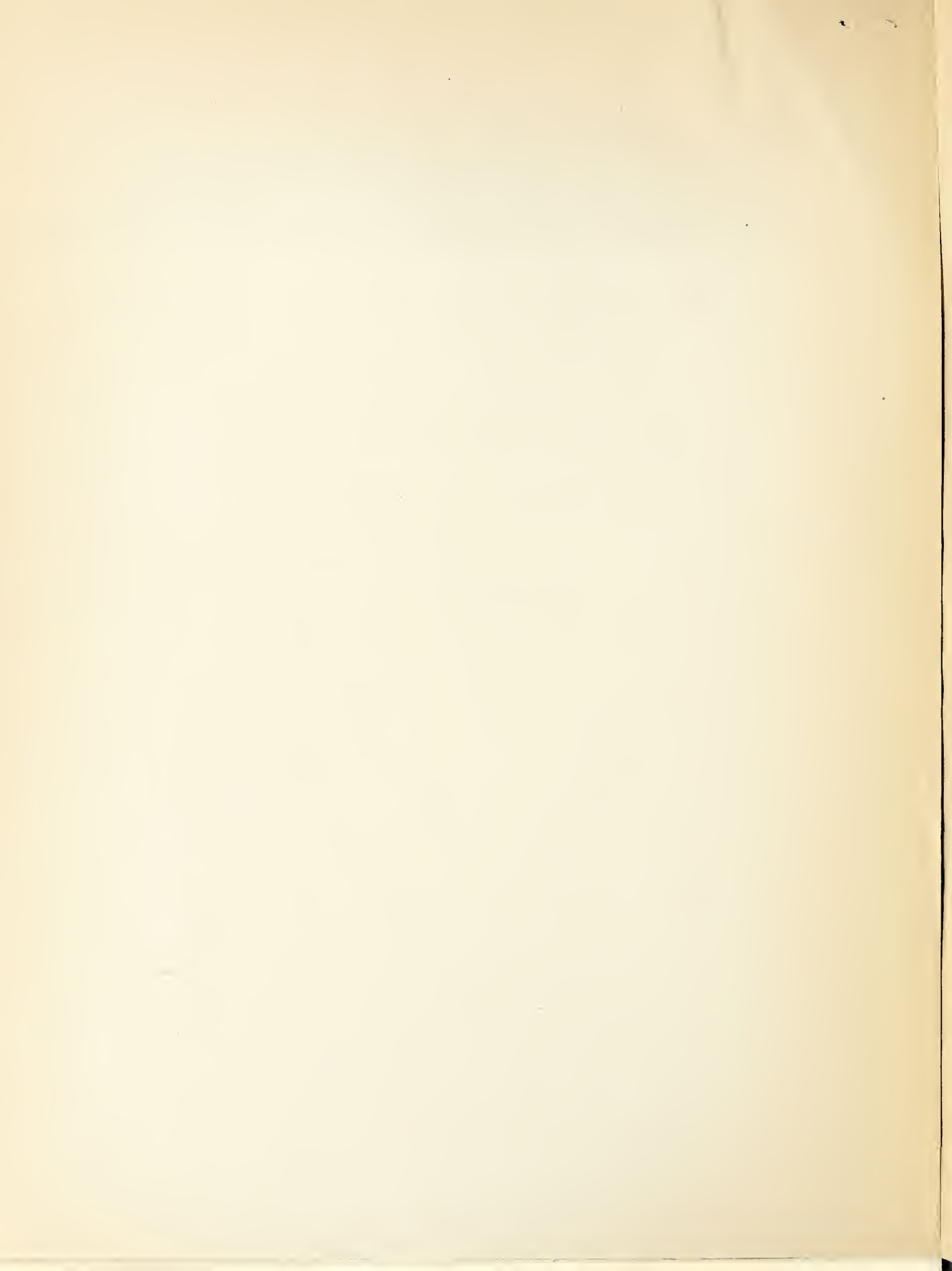
Barberry Bees

Barberry bees or eradication days have been organized to rid some communities of all barberries, especially in areas where many barberry bushes have escaped from cultivation or where large barberry hedges occur. These gatherings serve not only to get the barberries removed but to educate the members of the community on the relation of barberries to stem rust and give valuable publicity to the campaign. Such bees were held near Pine Island, and Red Wing, Minn., Mingo, Ohio, and Alert, Ind.

Five-Year Results

During the five years, 1918 to 1922, practically all cities and villages of the 13 States within the quarantine area have been surveyed. In the original farm-to-farm survey, an area equivalent to 472 counties has been covered. This includes 39 counties surveyed on funds furnished by States. During this 5-year period, 5,829,368 bushes have been found in the different States, as follows: Colorado, 24,001; Illinois, 142,882; Indiana, 96,284; Iowa, 764,096; Michigan, 265,109; Minnesota, 773,977; Montana, 9,027; Nebraska, 38,862; North Dakota, 19,438; Ohio, 239,083; South Dakota, 52,309; Wisconsin, 3,354,155; Wyoming, 4,140. The removals total 5,173,547 bushes. The remaining two-thirds of a million are mostly in one or two small areas of escaped bushes and most of them are seedlings.

Table 1 shows the survey results by States for the calendar year, January 1 to December 31, 1922. Table 2 shows the survey results by States for the 5-year period, April 1, 1918, to December 31, 1922. Table 3 shows the results by calendar years for the 5-year period, April 1, 1918, to December 31, 1922. Table 4 shows the number of counties covered in the original farm-to-farm survey by States for 6-months periods, January 1, 1919, to December 31, 1922, with totals for fiscal years and calendar years.



data showing, by States, the number of properties on which barberry bushes were found and the number of bushes located and removed in the barberry eradication campaign from January 1 to December 31, 1922.

Number of properties on which bushes were found				Number of bushes				Sprouts		
In cities and towns :	In country :	Total :	Cleared of properties :	In cities and towns :	In country :	In both cities and country :	Found and removed in the resurvey of 201 counties :	Found and removed in the resurvey of 201 counties :	Sprouts :	
27	11	19	46	46	360	1,004	1,093	1,453	1,365	2,458
675	112	285	960	1,312	4,269	1,828	3,624	8,093	14,889	1,029
116	59	229	345	349	629	3,901	7,921	8,550	7,662	14,577
95	151	595	690	672	917	18,750	31,439	32,356	29,682	28,628
330	141	496	826	924	5,083	77,517	88,750	93,833	101,212	841
202	142	649	851	874	2,890	21,987	34,779	37,669	35,716	23,513
4	1	5	9	2	81	41	264	345	9	256
41	26	213	254	246	245	2,036	4,983	5,228	5,246	8,145
21	0	91	112	112	185	0	2,138	2,323	2,323	1,132
640	25	363	1,003	1,084	3,444	853	3,777	7,221	11,071	2,188
28	15	141	169	163	284	1,772	5,990	6,274	8,394	2,522
230	147	423	653	600	1,117	3,676	4,935	6,052	509,353	3,435
0	0	0	0	24	0	0	0	0	2,799	16
2,409	830	3,509	5,918	6,402	19,504	133,365	189,893	209,397	729,721	88,740

Table 2, Data showing, by States, the number of properties on which barberry bushes were found and the number of bushes located and removed in the barberry eradication campaign from April 1, 1918, to December 31, 1922.

State	Number of properties having bushes				Number of bushes				Spirouts	
	In cities and towns	In country	Total	Cleared	In cities and towns	In country	Total	In both cities and country	Found	Removed
Colorado	1,526	30	116	1,642	19,532	2,415	4,469	24,001	23,822	5,684
Illinois	8,399	458	1,079	9,478	96,769	27,463	46,113	142,832	129,786	3,365
Indiana	3,252	114	701	3,953	75,917	8,074	20,367	96,284	94,004	17,037
Iowa	6,779	356	1,611	8,390	643,461	50,966	120,635	764,096	761,227	35,130
Michigan	4,204	1,046	4,121	8,325	44,443	154,477	220,666	265,109	221,090	1,030
Minnesota	2,980	357	1,650	4,630	591,624	75,496	187,353	778,977	776,803	38,940
Montana	156	2	43	204	6,658	42	2,369	9,027	8,680	4,771
Nebraska	3,019	43	478	3,497	71,541	5,221	17,321	88,862	88,180	11,421
No. Dakota	495	1	236	731	14,265	150	5,173	19,438	19,438	1,623
Ohio	5,130	90	918	6,048	200,564	20,627	29,524	230,088	210,438	4,469
So. Dakota	409	80	430	839	22,507	16,179	29,802	52,309	47,302	4,090
Wisconsin	6,157	614	1,863	8,020	277,790	3,067	3,076	3,354	2,788	16,521
Wyoming	74	1	13	87	3,946	1	194	4,140	3,841	256
Total	42,580	3,192	13,264	55,844	2,069,017	3,428,550	3,760,351	5,829,368	5,173,547	144,337

Table 3, Data showing, by calendar years, the number of properties on which barberry bushes were found and the number of bushes located and removed in the barberry eradication campaign from April 1, 1918, to December 31, 1922.

Calendar Years	Number of properties having bushes				Number of bushes				Sprouts	
	In cities and towns	In country	Total properties	Cleared of bushes	In cities and towns	In country	Total bushes	In both cities and country	Found and removed in the resurvey	Removed in the resurvey
1918	22,044	127	1,166	23,210	16,764	1,665,898	77,438	176,341	1,842,239	1,690,475
1919	14,104	1,298	4,611	18,715	16,848	337,246	1,630,806	1,758,817	2,096,063	2,025,389
1920	1,253	384	1,675	2,928	5,635	13,103	1,436,282	1,492,904	1,506,007	518,315
1921	2,770	553	2,303	5,073	6,337	33,266	100,659	142,396	175,662	209,647
1922	2,409	830	3,509	5,918	6,408	19,504	133,365	189,893	209,397	729,721
Total	42,580	3,192	13,264	55,844	51,992	2,069,017	3,428,550	3,760,351	5,829,368	5,173,547
										144,337

Table 4, Data showing, by States, in fiscal and in calendar years, the progress of the county survey in barberry eradication from January 1, 1919, to December 31, 1922.

Original farm-to-farm survey only

State	Total counties	Numbers of Counties Surveyed in Fiscal and Calendar Years												Total counties	
		1919	1920	1921	1922	1923	1923	1923	1923	1923	1923	1923	1923	Surveyed	Remaining
In	ing	Jan.-	July-	Jan.-	July-	Jan.-	July-	Jan.-	July-	Jan.-	July-	Jan.-	July-	completed	to be surveyed
State	Survey	June	Dec.	June	Dec.	June	Dec.	June	Dec.	June	Dec.	June	Dec.		
Colorado	63	32	0	12	1	8	6	0	0	3	0	0	0	30	2
Illinois	102	102	0	1	0	3	3	0	0	6	0	0	0	15	87
Indiana	92	92	0	12	1	6	5	2	2	17	0	0	0	49	43
Iowa	99	99	0	1	0	15	3	0	0	29	0	0	0	62	36
Michigan	83	69	0	0	0	5	1	0	0	9	0	0	0	1	49
Minnesota	85	86	0	3	0	9	3	0	0	10	0	0	0	36	12
Montana	54	12	2	6	0	2	0	0	0	2	0	0	0	12	0
Nebraska	93	89	0	6	1	10	4	3	3	29	0	0	0	65	24
No. Dakota	53	50	0	4	0	7	3	0	0	16	0	0	0	37	13
Ohio	88	88	0	0	1	7	1	1	1	13	0	0	0	29	59
So. Dakota	78	74	0	1	0	7	1	1	1	23	0	0	0	44	30
Wisconsin	70	65	0	0	0	4	1	1	1	16	0	0	0	26	39
Wyoming	23	8	0	0	0	0	5	0	0	0	0	0	0	8	0
Totals	924	886	2	46	4	83	35	82 Fed.	8 Fed.	173 Fed.	433 Fed.	394			
Totals for fiscal years	2	50	118	90 Fed.	1 St.	15 St.	433 Fed.	394							
Totals for calendar years	48	87	117 Fed.	181 Fed.	15 St.	433 Fed.	394								
			23 St.	16 St.											

*Fed. = Federal funds; St. = State funds.

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Table 1. Data showing results obtained in the barberry eradication campaign from July 1, 1922 to Oct. 31, 1922.

State	Number of properties having bushes				Number of bushes				In both cities and country			
	In : In country	Total	Cleared :	Of : cities:	In : In country	Total	Found	Removed :	and removed			
	cities:	Fscaped:	Total	Properties:	bushes :	and :	towns :	resurvey				
Colorado	17:	7:	11:	28:	31 :	315 :	960 :	1044 :	1359 :	1268 :	2167	
Illinois	630:	111:	271:	901:	945 :	4098 :	1811 :	3164 :	7562 :	7471 :	1019	
Indiana	91:	55:	198:	289:	268 :	391 :	3799 :	6449 :	6843 :	5685 :	13962	
Iowa	88:	112:	522:	610:	597 :	834 :	15868 :	27056 :	27692 :	27276 :	11157	
Michigan	324:	134:	464:	788:	838 :	4977 :	77353 :	88497 :	93474 :	95197 :	376	
Minnesota	162:	128:	575:	737:	719 :	2441 :	11597 :	20787 :	23228 :	22357 :	19814	
Montana	4:	1:	5:	9:	2 :	81 :	41 :	264 :	345 :	9 :	256	
Nebraska	32:	8:	169:	201:	223 :	154 :	570 :	4757 :	4911 :	5190 :	8137	
North Dakota	14:	0:	79:	93:	93 :	85 :	0 :	1770 :	1855 :	1855 :	802	
Ohio	398:	24:	301:	699:	686 :	2356 :	845 :	3462 :	5818 :	5043 :	1592	
South Dakota	23:	12:	129:	152:	118 :	176 :	1042 :	5183 :	5329 :	5568 :	1314	
Wisconsin	116:	53:	294:	410:	177 :	349 :	1420 :	2369 :	2738 :	505604 :	2014	
Wyoming	:	:	:	:	20 :	:	:	:	:	100 :		
	1899	650	3016	4917	5017	16260	115306	163686	161351	622705	63410	

Table 2. Data showing results obtained in the barberry eradication campaign from January 1, 1922 to Oct. 31, 1922.

State	Number of properties having bushes:				Number of bushes				In both cities and country				Sprouts found and removed in the resurvey
	In country	Escaped	Total	Cleared	In country	Escaped	Total	Found	Removed	Found	Removed	Found	
Colorado	26	11	19	45	45	340	1004	1093	1433	1345	2458	2458	
Illinois	673	112	280	953	1292	4264	1828	3813	8077	14811	1019	1019	
Indiana	106	57	211	317	310	534	3835	7808	8342	4190	14482	14482	
Iowa	88	116	536	624	610	834	15918	27733	28567	27753	28608	28608	
Michigan	324	134	465	789	872	4977	77353	93475	93475	96041	445	445	
Minnesota	171	132	601	772	775	2508	11623	21197	23705	22746	20291	20291	
Montana	4	1	5	9	2	81	41	264	345	9	256	256	
Nebraska	33	12	191	224	245	156	626	4912	5068	5240	8145	8145	
No. Dakota	19	0	90	109	109	176	0	2133	2309	2309	1132	1132	
Ohio	436	24	307	743	819	2467	845	3468	5935	6936	1845	1845	
So. Dakota	25	13	136	161	145	183	1047	5212	5395	7000	2057	2057	
Wisconsin	157	117	375	532	552	598	2379	3513	4021	505838	3388	3388	
Wyoming					23					299	16	16	
	2062	729	3216	5278	5799	17028	116499	168236	186672	696517	84142	84142	

Table 3. Data showing results obtained in the barberry eradication campaign from April 1, 1918 to Oct. 31, 1922

State	Number of properties having bushes:				Number of bushes				In both cities and country				: and removed in the resurvey
	: In country	: Total	: Escaped	: Total	: In country	: Escaped	: Total	: Found	: Removed	: Found	: Removed	: Found	
: cities:	: Escaped:	: Total:	: Proper-	: of	: cities	: Escaped	: Total	: Found	: Removed	: Found	: Removed	: Found	
: and	:	:	: ties	: bushes	: and towns:	:	:	:	:	:	:	:	
: towns:	:	:	:	:	:	:	:	:	:	:	:	:	
Colorado	1525:	30:	116:	1641:	1638:	19512:	2415:	4469:	23981:	23802:	5684		
Illinois	8397:	458:	1074:	9471:	9065:	96764:	27463:	46102:	142866:	129698:	3355		
Indiana	3242:	112:	683:	3925:	3884:	75822:	8008:	20254:	96076:	92532:	16942		
Iowa	6772:	320:	1552:	8324:	8303:	643378:	48134:	116929:	760307:	759298:	34788		
Michigan	4198:	1039:	4090:	8238:	6438:	44337:	154313:	220414:	264751:	215919:	634		
Minnesota	2949:	347:	1602:	4551:	4512:	591242:	65132:	173771:	765013:	763,833	35718		
Montana	156:	2:	48:	204:	196:	6658:	42:	2369:	9027:	8680:	4771		
Nebraska	3011:	29:	456:	3467:	3152:	71452:	3811:	17250:	88702:	88182:	11421		
No. Dakota	493:	1:	235:	728:	728:	14256:	150:	5168:	19424:	19424:	1623		
Ohio	4926:	89:	862:	5788:	5137:	199587:	20619:	29215:	228802:	206303:	4126		
So. Dakota	406:	78:	425:	831:	721:	22406:	15454:	29024:	51430:	45908:	3625		
Wisconsin	6084:	584:	1815:	7899:	7532:	277181:	3066142:	3074943:	3352124:	2785421:	16474		
Wyoming	74:	1:	13:	87:	77:	3946:	1:	194:	4140:	1343:	256		
	42233:	3090:	12971:	55204:	51383:	2066541:	3411684:	3738694:	5806643:	5140343:	139357		

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